Physics 131
General Physics I
Grinnell College

Homework II

Session II.2

1. One kilogram weighs about 2.2 pounds. If the force on 1 kg is 9.8 Newtons, what is the force of gravity on me, given that I weigh 165 lbs?

2. Using what you learned in class, explain why it is harder to get a car moving by pushing than it is to get a bicycle moving by pushing?

3. My battery on my car has died, and I want to push start it. To do this, I have to get the car up to 1 m/sec speed first. I only have a 20 m stretch of smooth pavement to do this starting from zero velocity. What acceleration do I need to do this? [Hint--you need to write two equations down--one for total distance and one for final velocity in terms of two things you don't know, time and acceleration, and then solve for the acceleration.]

Session II.3

4. A typical car weighs about 1000 kg. An average person can push with a force that is about half the force of gravity on her body, say about 500 N. What is the maximum acceleration of a car that can be expected by one person pushing it? How long would it take at that acceleration for the car to reach walking speed of about 1.5 meters/sec from an initial speed of zero? How far (in meters) has the car moved when it reaches that velocity?

5. A 3 kg block is sitting on a table. What is the force of gravity acting on that block? Why doesn't the block move? Can you say anything about other forces acting on the block (direction, magnitude)?

6. Hanging a 100g weight on an ideal Hooke's Law spring stretches it 1.2 cm. I remove that weight, and hang an unknown weight on the spring. It stretches 6.3 cm. What is the mass of the unknown object? Explain your reasoning.

Session III.1

7. In the following, consider an object moving under the influence of a spring force. Assume the only force present is the spring force.

a) Sketch qualitatively the position as a function of time, and acceleration as function of time graphs.

b) Where is the position largest? Where is the acceleration largest?

c) Does your answer to b make sense, given Newton's second law (F=ma) and the spring force law (Hooke's law, F = -kx)? Explain.

8. If the force of sliding friction is a constant, sketch a plausible acceleration versus time graph for a sliding object. Sketch the corresponding velocity and position graphs. Make sure to pay attention to what happens in the graph when the object stops.

9. The velocity of an object is given by

$$v(t) = 5\cos(4t).$$

a) What is the position of the object at $t = 0$?

b) What is the acceleration of the object at $t = 0$?